THE MAGAZINE OF LIGHT

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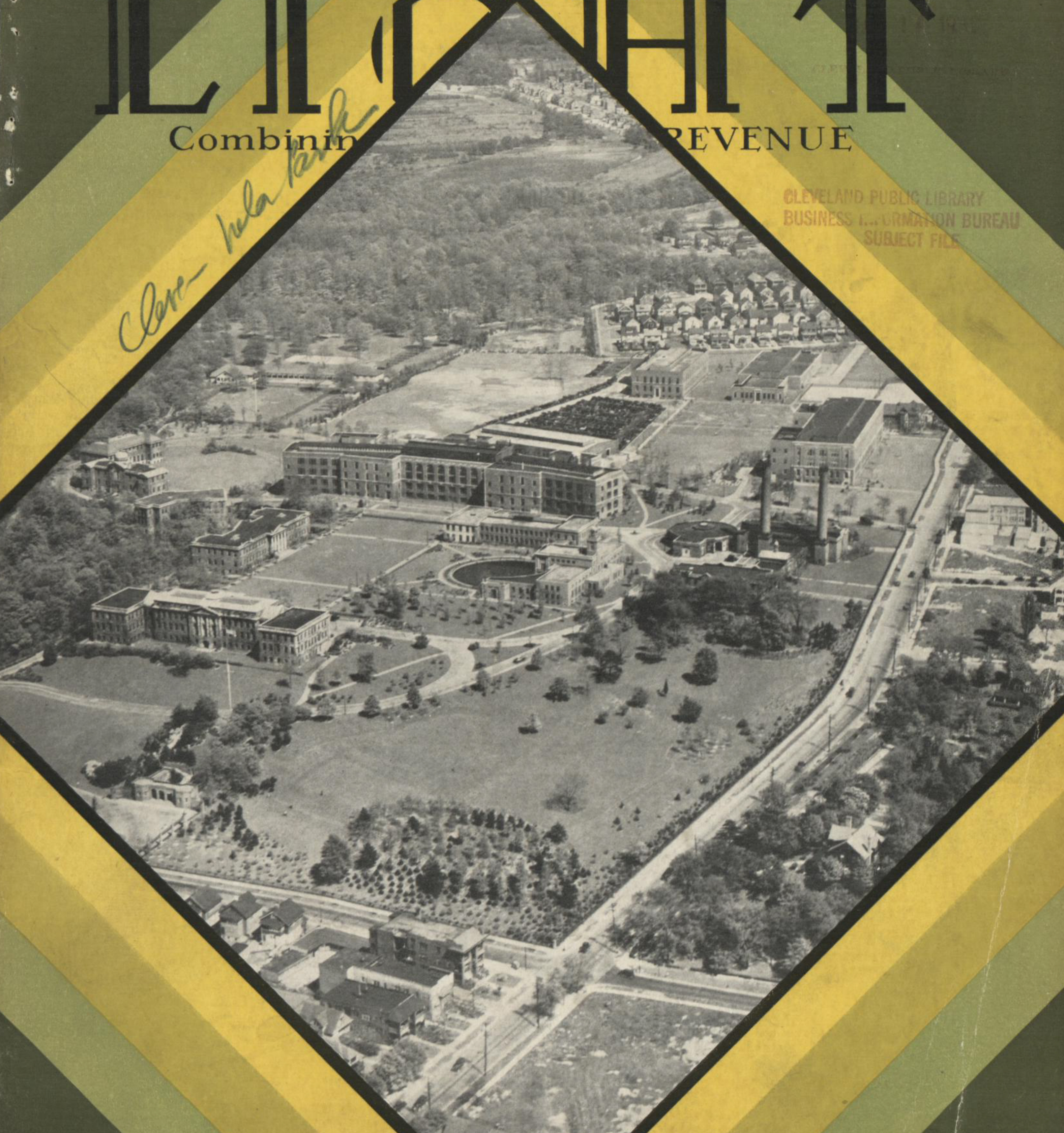

MAY 1931

MAZDA LAMPS

are Nationally Advertised

. OVER 126,000,000 impressions of MAZDA* Lamp advertisements will be printed and these will be seen and read not only by the people in your community who are now your customers, but also by those whom you would like to have buy at your store. These MAZDA Lamp advertisements are unusually colorful, forceful and attractive; they serve the public very definitely by telling them how to get the best lighting results in their homes, offices, factories and stores . . . what lamps to use . . . and where to use them.

Make this advertising **your own advertising** by persistently identifying your store as the place to buy these nationally advertised quality products. You can do it easily and profitably by consistent, regular use of the excellent window and store display material available to you. Why not cash in on the demand already created?

*MAZDA . . . NOT THE NAME OF A THING
BUT THE MARK OF A RESEARCH SERVICE

INCANDESCENT LAMP DEPARTMENT
OF GENERAL ELECTRIC CO.
NELA PARK, CLEVELAND, OHIO

EDISON MAZDA LAMPS — GENERAL ELECTRIC MAZDA LAMPS

JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N. B. C. NETWORK.

THEN AND NOW—A REVIEW OF

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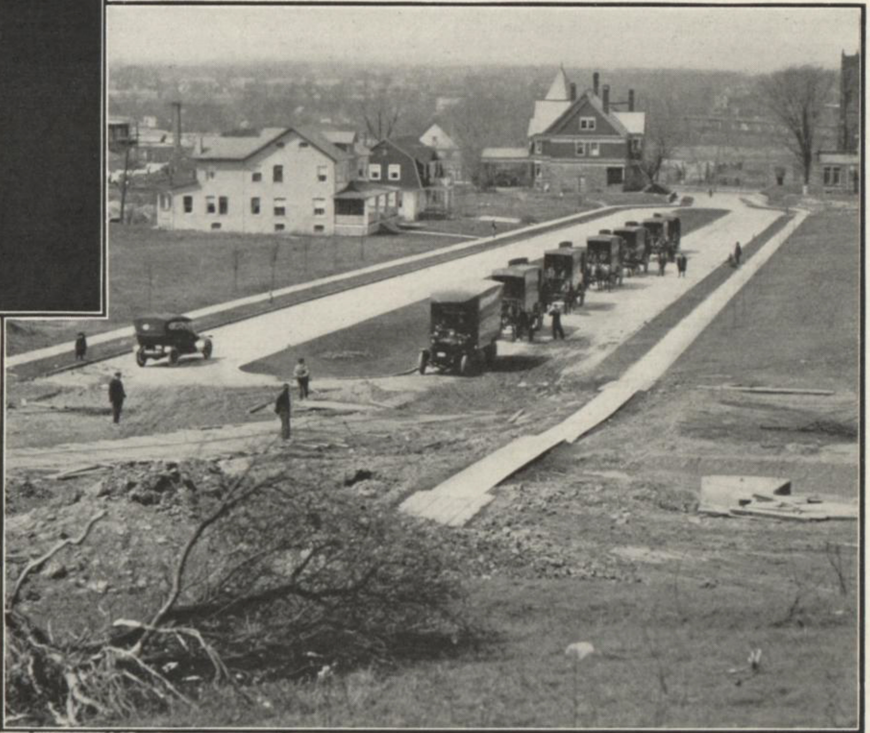
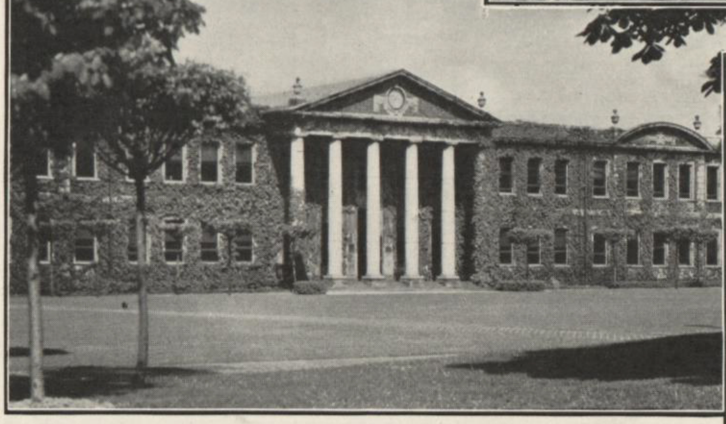
Mr. F. S. Terry, great humanitarian of business whose philosophy was expressed in the phrase, "I would rather make men than money"

EVERY account of Nela Park must begin with recalling the men whose ideas and ideals brought this unique industrial capital into being.

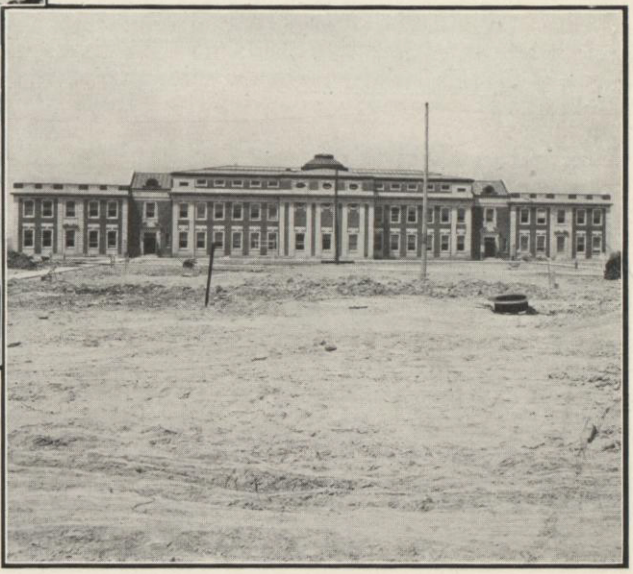
F. S. Terry and B. G. Tremaine discovered about twenty years ago that they could build an expansive group of buildings on an attractive site in the suburbs of Cleveland for the price of a downtown skyscraper. They already had the notion that people could work better and accomplish more if their working environment were pleasant and inspiring.



Right: One day in 1913, employees were told to report to Nela Park on the morrow. Overnight every moving van in Cleveland was busy, and the next morning every office was in order at Nela



Above: The Sales Building in 1931 has the mature distinction although still in its teens. On the opposite page the same building in 1913



Right: Looking toward the Engineering Building from the same point today the eye is greeted with a velvety expanse of lawn

editorial

PERSPECTIVE. Just the other day we saw the world's largest airship nearing completion for her maiden voyage during the coming summer. It was a great sight and a thrilling one. By many comparisons this ship is a veritable leviathan, and to know the facts about her in terms of tons, horsepower, cruising distance, and carrying capacity is to appreciate and respect the intelligence and skill that has made her possible.

By a coincidence, however, we were reading the same day Sir James Jeans' observations about things big and little in his revealing book, "This Mysterious Universe." By comparison Sir James finds our earth a "millionth grain of sand." In his way of viewing things, such consequential matters as the world's largest airship fade into insignificance.

And the next day we talked to a lamp merchant who was feeling blue about business, and convinced that "you have to be big to get anywhere nowadays."

Well, philosophy, like advice, is too cheap, and too weak a tonic to offer a man who has "done his best" so we sympathized and agreed there was much truth in his conclusions. But the mixture of aëronautical and astronomical facts we had absorbed the day before suggested another attitude we might take if we were in the other fellow's shoes. (You can do this, you know, if you are not actually in them.)

Between the awe we feel for the world's largest airship and the awe for a universe in which the earth is a "millionth grain of sand" there is just the difference of perspective. Most of us are airship builders in times of general prosperity, and microscopic nothings on a grain of sand when times are dull. And from time to time we get so confused in our perspectives we feel we must be led around by the nose, and that individual initiative and self reliance are futile.

Right along this line we recall a young man who felt the big business he was with was wasting his time. So he went across the street and opened an electrical store in a year of depression. His capital was his energy and his confidence, and he had his mind made up. Because they involved no outlay, and no risk, and because they were easy to sell, he decided to make lamps the bulwark of his business. On this basis he has built a substantial, profitable enterprise. Had he been a more timid soul it would never have happened.

Because time and tide do not stand still for ordinary individuals, like they do for astronomers, we must dare to conceive and do—right now.

LEADERSHIP. This issue of The Magazine of Light is chiefly concerned with material about Nela Park, the General Electric Company's "University of Light" at Cleveland.

Although Nela has been in existence for nearly twenty years, and although we believe her fame has spread far and wide, we are anxious to convey the thought that the spirit and purpose of this great institution is growing and achieving greater service. While Nela accepts the responsibilities of leadership in lighting, she does so with the determination to keep that leadership constantly renewed with a continually improved product at consistent prices.

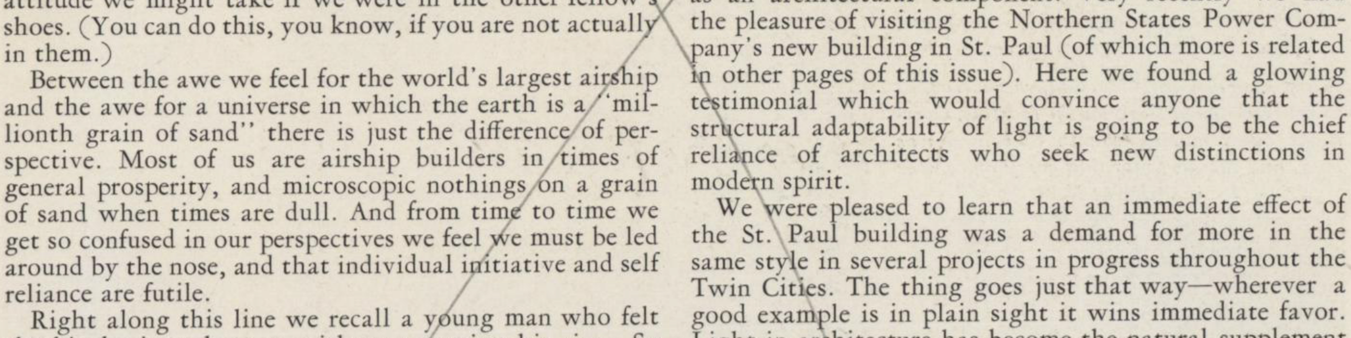
From its inception Nela has represented ideals which had their goal in results beyond the ordinary objects of industrial enterprise.

In reviewing the origin of Nela, the hopes and ambitions of its founders, its accomplishments and its present program looking towards newer and greater blessings in modern illumination, The Magazine of Light presents this issue as an up-to-date reference. Nela looks with confidence to the future. The science, art and business of lighting is still young, still holds opportunity for greater development, and in that growth The University of Light expects to reaffirm the relationship to the lighting industry it has held thus far.

LIGHT IN ARCHITECTURE. Within the past year we have had increasing evidence of the growing appreciation of light as an architectural component. Very recently we had the pleasure of visiting the Northern States Power Company's new building in St. Paul (of which more is related in other pages of this issue). Here we found a glowing testimonial which would convince anyone that the structural adaptability of light is going to be the chief reliance of architects who seek new distinctions in modern spirit.

We were pleased to learn that an immediate effect of the St. Paul building was a demand for more in the same style in several projects in progress throughout the Twin Cities. The thing goes just that way—wherever a good example is in plain sight it wins immediate favor. Light in architecture has become the natural supplement to the floodlighted exterior. And wherever a structure has claim to eminence, specifications in the future are bound to carry more and more built-in lighting.

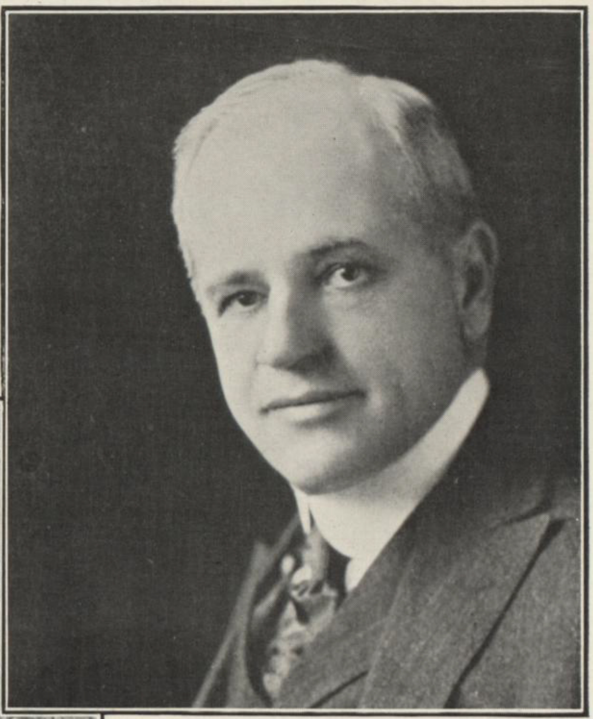
To the Northern States Power Company and to the Niagara Hudson Company, who have had the initiative to give the country recent fine examples of this development, much praise is due. In a totally distinct application, the illumination of Severance Hall has demonstrated the wide range of possibility with light in architecture. The movement in this direction is auspicious and encouraging, and will be worth following.



NELA HISTORY FROM 1913 TO 1931

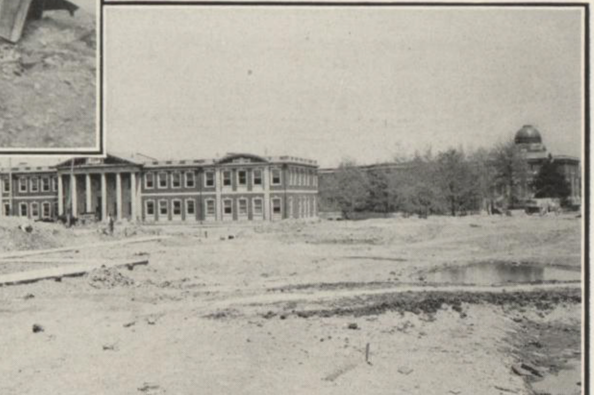
Because these things coincided with the need for a quiet location for scientists engaged in research problems that the jar and rumble of city traffic made arduous, Partners Terry and Tremaine secured ninety acres on a hilltop eight miles from the business center of Cleveland.

There they built, upon a completely developed architectural plan, a series of fine two-story buildings which comprise Nela Park. It has been called "The University of Light" because it is the headquarters of the world's greatest factor in modern illumination, the General Electric Company.

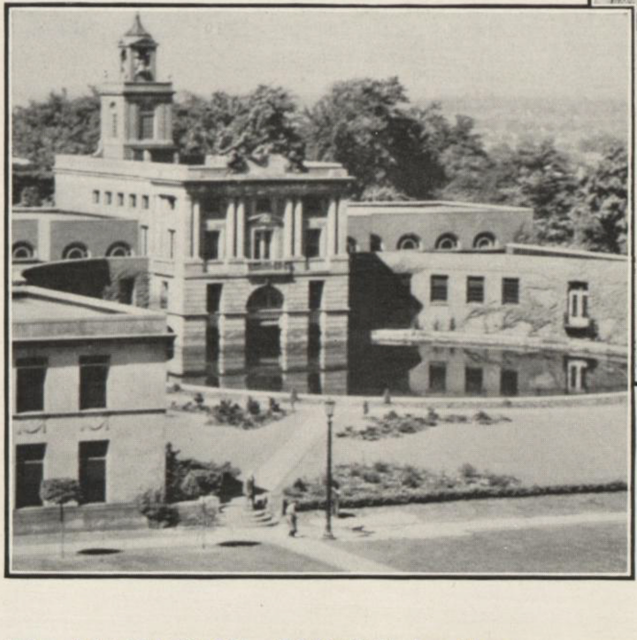


Mr. B. G. Tremaine, beloved by a host of men for whom his leadership, his sound advice and smiling humor has fixed their loyalty

Left: At the laying of the cornerstone of the Sales Building there were several young men whom many of the readers of this magazine will recognize



Above: This photo taken at peaceful Nela in 1913 shows the Sales Building in a Flanders Field setting which was quickly put in shape



Left: The circular reservoir reflecting the façade of the Dining Hall is typical of the scenery at Nela now

WHAT NELA PARK *and its* ORGANIZATION MEAN TO YOU . .

BY H. F. BARNES

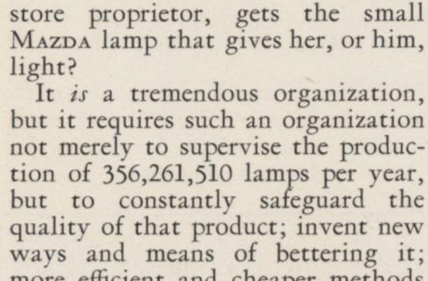
Manager Nela Park Sales Promotion Dept.

HERE'S an interesting recipe for you! Take about 1,400 people, 443 offices and 84 engineering laboratory rooms, mix well with 600,000 square feet of floor area, distribute it over 16 buildings, scatter over 90 acres of beautiful country-side, season for a few dozen years, and you will have what constitutes the physical side of the headquarters' organization at Nela Park—the lighting headquarters of the General Electric Company—and the world.

What a tremendous organization, you remark. Why such a force at headquarters to see that Mrs. Jones, the housewife, or Mr. Smith, the store proprietor, gets the small MAZDA lamp that gives her, or him, light?

It *is* a tremendous organization, but it requires such an organization not merely to supervise the production of 356,261,510 lamps per year, but to constantly safeguard the quality of that product; invent new ways and means of bettering it; more efficient and cheaper methods of production and new and improved methods of using it.

For the $300,000,000[1] that *all* the Joneses and Smiths do *not* have to pay each year for lighting you can thank that organization. A price decrease of 57 per cent in lamps since 1914 can be attributed to the activities of this group. To the improvement in lighting standards of over 100 per cent in the past 15 years, this lighting headquarters played a major part.



Since 1914 half again as much light per watt for the 100-watt lamp

The fact that you can get a lamp of highest quality at uniform prices in *any* city or hamlet, the kind you want, when you want it—is a tribute to the thinking, planning and executing of that organization.

And to you who sell MAZDA lamps, Nela Park represents the leading laboratory of merchandising research for those advanced sales ideas which make lamps the profitable item they are.

There are many branches of this organization at Nela Park. Let's take it apart and see how it functions.

Administration Department

Every organization, every business, every store, no matter how large or small, has its Administration Department. This is the department which establishes general policies and coördinates the efforts of all the other departments, divisions and sections.

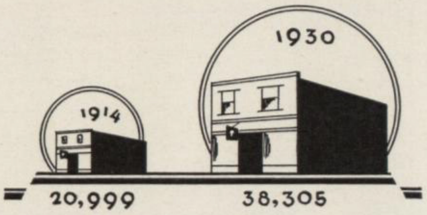
Under this administration at Cleveland, comes such general departments as Auditing, Accounting, Operating, Investment, Law, Plant Engineering, Purchasing, Statistical, Contract Supervision, etc., as well as Manufacturing, Engineering and Sales.

Manufacturing Department

Suppose you wanted to go into the business of making lamps. Suppose further, that you knew nothing about lamp making. You look at a lamp. It represents, as far as you can see, some glass, a brass base, leading-in wires and a little filament. Simple, isn't it? But, you would probably ask yourself, "What *kind* of leading-in wire, what size, what type, length, diameter of filament etc.," and you would realize at once that before you could do anything toward making lamps, you would need to call in engineers who could either answer these problems for you or work them out for you.

When Mr. Edison made his first lamp, his whole operation was one of lamp engineering and of lamp development. Naturally, even though lamp making has progressed immeasurably since that time, the engineering end of the lamp business and the development of the product, are the keystones of the organization. Thus, it is understandable that one of the largest departments at Nela Park is the Lamp Development Laboratory which, in conjunction with the MAZDA Research Laboratories at Schenectady, is largely responsible for the continued improvement in quality of lamps which are in general use, as well as the development of new lamps for new fields and new applications.

Ask any person to describe a lamp. He would probably start off with a reference to *glass*. And because *glass* is such an important part of the lamp itself you will find at Nela Park an entire division devoted to not only research but manufacturing as well.



Number of agents in 1914 and 1930

Many of the major problems in conjunction with lamp making are those that deal with the manufacturing and handling of the proper kinds of glass.

Well, let's assume you have established a complete engineering department and, knowing how to make a lamp, you are ready to start building a factory—just as Mr. Edison did 50 years ago. At that time, and for years afterward, everything about a lamp was made by hand. This made lamps expensive. So, if you wanted to produce lamps in large numbers, your thoughts would immediately turn to the development of a machine which could replace hand labor, increase production and cut costs.

There's no question but that the development of machines for making lamps has been the major factor in increasing quantity and quality as well as decreasing price. Consequently, yet another division of the Nela Park organization wrestles with problems in connection with the development of machines. They are ever scrapping their masterpieces of yester-year and producing new machines, still more uncanny in their accuracy in making lamps more

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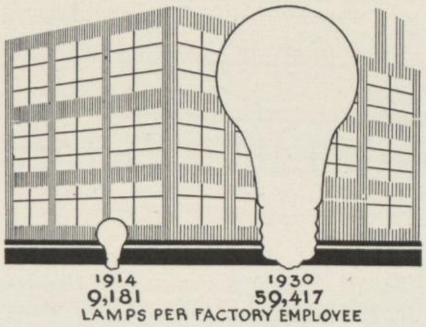
[1] Estimated saving to public today by reason of improved lamp efficiency and price reduction.



perfectly than human hands could do.

So, we have the instructions from the engineers on how to make a lamp; the specifications as to the various types of material; the machines to produce this lamp; and all that remains, you say, is to set up a factory organization. But, if you are planning on producing hundreds of thousands of lamps per year, in many different factories, employing thousands of people, you face the problems of standardizing your methods and your material, so that no matter where your unit operates you would be obtaining uniform results.

Thus, at Nela Park, over a period of years, has grown up a department known as the Standardizing Department, whose ramifications are many, but in the manufacture of lamps is just as necessary as the engineering and factory departments themselves.

The Factories Themselves

To make these 356,000,000 lamps per year, our Company requires seven large lamp factories, three miniature lamp factories and eleven lamp-part factories scattered throughout the country. At Nela Park, is the headquarters organization of the manufacturing end of the business. It is through these heads that the developments in equipment, in glass, in lamp making, in standardization, are passed along, supervised and controlled in these widely separated factories which produce the product which you actually use or sell.

Warehousing and Transportation

When you think of 356,000,000 lamps, filling, when packed for shipment, 4612 freight cars, representing a single freight train over 40 miles long, you can realize that such a train, to discharge its load, must necessarily stop at more than one station and its shipments must needs be divided and subdivided among many hundreds of distributors, many thousands of retailers and contract purchasers. Therefore, you begin to see the problem of warehousing, transportation and distribution.

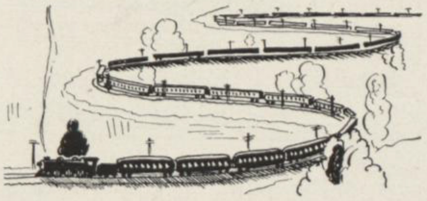
At Nela Park, the directing heads of this branch of the business are located. Through them has come the greatest system of warehousing and transportation known to industry—a system which makes possible almost overnight delivery to any point in the country; a system that has aided materially in reducing cost and enabling the General Electric Company constantly to reduce prices in addition to rendering each year, faster and better service to its customers.

* * *

To you, who buy or sell lamps, many of these operations you do not see and consequently may know very little about. Now, what about those things you *do* see and come in contact with? How does the Nela Park organization affect them?

The Lamp Itself

You have seen, briefly, what Nela Park is doing as regards lamp engineering. You know that the lamp you buy today which, compared with the lamp of 1914, gives you over 50 per cent[2] more light per watt, must be the result of some group of men who are constantly studying and improving the quality of the product itself. Therefore, you are interested—because it affects your pocketbook—in what Nela Park does in the development of lamps, and the machinery which makes them, and the transportation of these lamps from the factory into the store, home, or place of business.



Packing

Another thing you see, which to you may seem a small item and yet is a very important one, is the packing material that goes around that lamp—the material which serves the purpose of not only aiding you to sell it to the consumer in an attractive package, but also of insuring that that lamp gets to you and the consumer in as perfect condition as the day it left the factory. We have men devoting their entire time to devising ways and means of making packing better, more substantial, more attractive, and as cheaply, of course, as it can be done with all these things in mind.

As field conditions change, as new lamps come on the market, as new uses are found for lamps, the development of packing must go hand in hand, and so, the little piece of cardboard with colored inks that the consumer so quickly throws away as the lamp is put in use, is in reality an item of major importance.

It is this packing which permits any consumer, no matter where he is located, to receive a lamp in the same condition as though he had stood beside the lamp-making machine and carried away the lamp himself as it came from the final inspection.

Engineering Department

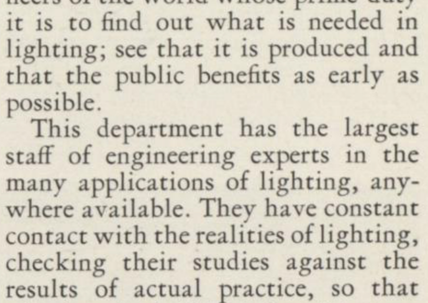
Almost hand in hand with lamp engineering comes *lighting* engineering—that service devoted to knowing and seeking out the requirements of every lighting field, which sees to it that not only are MAZDA lamps made with such characteristics as will best serve each field, but also works with other manufacturers of glassware, reflectors, lenses, etc.—to complete the equipment that will give the user the fullest advantage of light for his particular purpose. Here are located the leading lighting engineers of the world whose prime duty it is to find out what is needed in lighting; see that it is produced and that the public benefits as early as possible.

This department has the largest staff of engineering experts in the many applications of lighting, anywhere available. They have constant contact with the realities of lighting, checking their studies against the results of actual practice, so that whether the field be industrial, commercial, street, sign, automotive, home or what not, their contributions are constantly giving the user more and more value for his lighting dollar.

Sales Promotion Department

As a seller of lamps you see and use the advertising material designed to assist you in producing greater sales at greater profits, and insuring for

(*Continued on page 37*)



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[2] For the 100-watt lamp.

Bottling Light

A Tour Through the Nela Park Lamp Factory

Personally Conducted
BY J. J. HENRIETTA

IN THE creation of light, dormant within the bottling husk of a MAZDA lamp and awaiting the surge of energy which is to give it radiance, perhaps few processes are more fascinating than the final assembly operation which ends with the completed lamp—already tested for perfection and quality.

From all quarters of the world have come the elements which are transformed and united into the final product: chromium from Siberia, wolframite from China, tinstone from Indo-China, titanium from Australia, cryolite from Greenland, feldspar from Sweden, cork from Spain, sienna from Italy, shellac from India, gum arabic from Africa, umber from Turkey, nitrates from South America, molybdenum from Canada, antimony from Mexico, and from the United States arsenic, copper, silver, scheelite, cotton, lead, iron, chrysolite, bauxite, phosphorus, sulphur, and many other materials, not to mention argon and nitrogen from the atmosphere. When these products reach the lamp factory they have already taken shape to be incorporated in the finished lamp. Bases have come from the base works, bulbs and glass tubing from the glass works, lead wires from the weld works, and filament wire from the wire works.

The Filament

The process of further transformation and combination of these materials begins with the coiling of the filament, which takes place upon a machine handling, with exacting accuracy, materials of infinitesimal measurements. The ability of these machines to perform this fine work, and the perfection and uniformity of the modern MAZDA lamp for which they produce the very heart, are a tribute to the ingenuity of man and one of the miracles of modern manufacture.

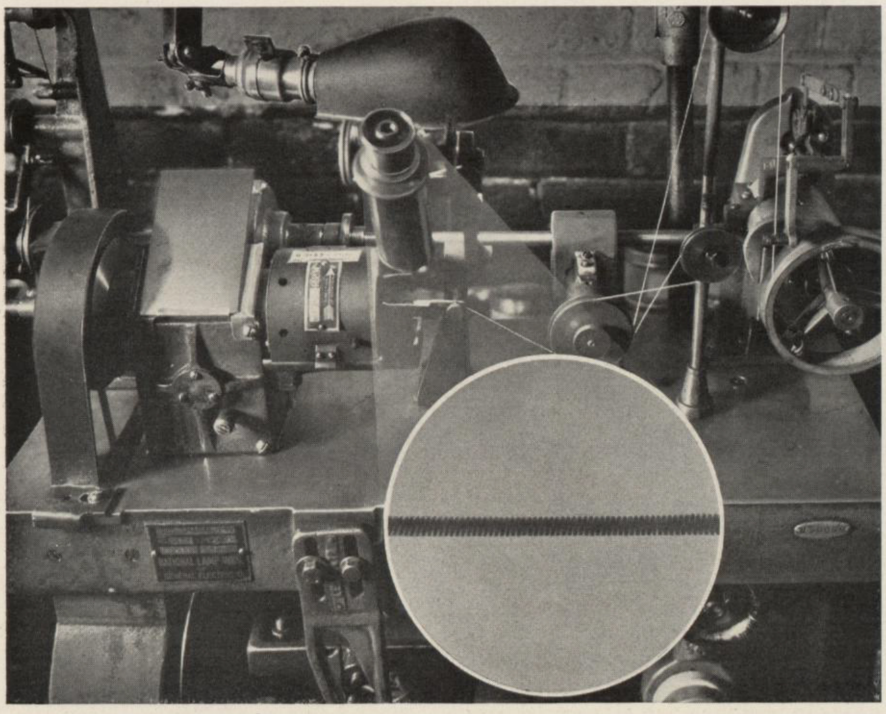
Even the relatively large filament for a 60-watt lamp is astonishingly minute. Imagine, if you can, a wire whose diameter is but half the thickness of the paper on which this is printed. Imagine a wire so fine that 32½ miles of it scarcely weigh a pound. Of this wire is made the 60-watt filament, each lamp requiring a length that weighs less than one one-thousandth of an ounce.

At the wire works this fine metal thread is drawn from a tungsten ingot scarcely larger than an orchestra leader's baton. Molded under pressure many thousand times as great as the wind pressure of our most destructive tornadoes, and drawn through alloy and diamond dies to more fineness than a hair, one of these ingots will make over ten miles of 60-watt filament wire and 150 miles of the finest filament produced.

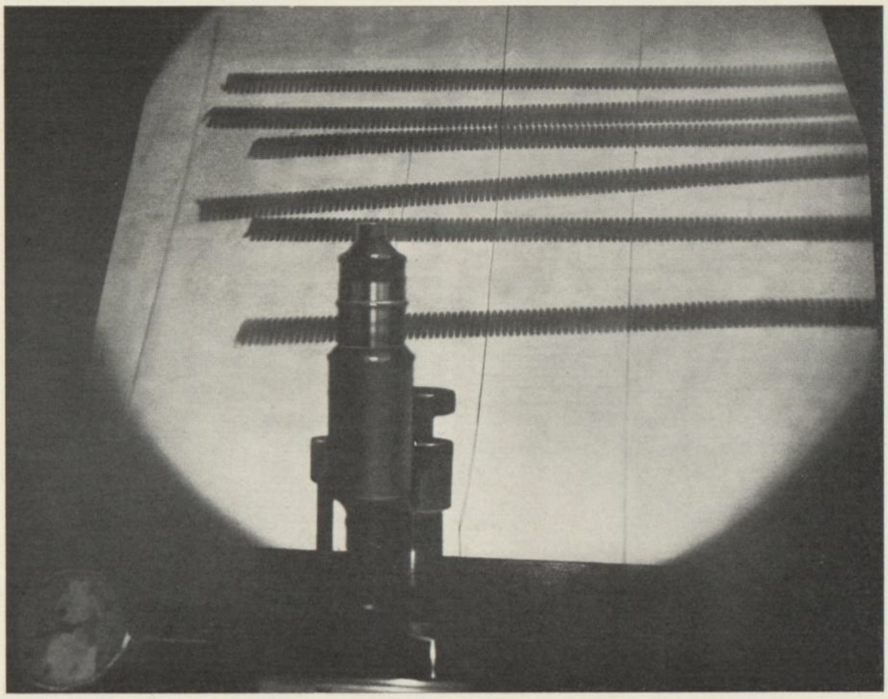
The 60-watt lamp requires approximately 1½ feet of this wire, which, however, is coiled so closely that it appears to be only about 1½ inches long—a twelfth of its actual length. Just so much wire of carefully determined specifications—no more, no less—is vital to the perfect operation of the lamp. So accurately must the size be determined that even the finest micrometer measurements are inadequate; only weighing, on delicate scales, will give the requisite precision. Yet absolute uniformity of filament is one of the foremost factors which have served to establish MAZDA lamp quality.

The winding of the filament is only one of the marvels of lamp making, but at the very start of one's trip along the lamp-making process inspires a lasting awe and wonderment. A bobbin holding a short length of tenuous wire is slipped into the heart of a small, intricate machine. Here an arm over which the wire is drawn leads it tightly around a steel mandrel serving as a core. As the wire is wound on a large spool at the other end of the machine it begins to be a lamp filament. After a precise mechanism cuts the coiled wire to extremely accurate lengths, it still, however, needs cleaning and still contains the core upon which it is wound.

Encased in metal containers which protect the delicate coils, but allow free passage to liquids and chemical solutions, the filaments now pass through baths which thoroughly dissolve out the mandrel, remove impurities, and wash the coils, which



This machine coils the filament about the mandrel. Through the microscope can be seen the filament as shown



High magnification on the screen enables deft inspectors to pass only perfect coils

are then carefully dried. Utmost care is accorded these operations, which are far more complex and painstaking than a superficial glance would reveal, and which play an important rôle in the production of really fine lamps.

Sintering follows. The containers, loaded with filaments, are each laid in a metal "boat" and placed in the hot zone of a longitudinal furnace, where the high temperature removes any remaining impurities. After sintering and cooling, the filaments are taken for inspection. Highly magnified, the image of the filament appears on an illuminated screen, enabling the inspector immediately to segregate those with irregularities which might prove detrimental to their life or performance.

Machine Development

A short distance from the lamp factory at Nela Park is a long, low building whose unassuming walls enclose operations that are among the most romantic of modern industry—the Equipment Development Laboratory.

We have already seen the delicacy and precision of the little machine which handles with unbelievable accuracy a tungsten thread as fine as a hair. When we follow the lamp upon its further course to completion through three other almost human machines, it will be even more apparent that only fine, high-grade machinery makes possible for 20c. a lamp that goes through such multitudinous and microscopic operations. The established quality, accuracy, and uniformity of the modern Mazda lamp is due in no small measure to the exactness and reliability of these iron and steel workmen.

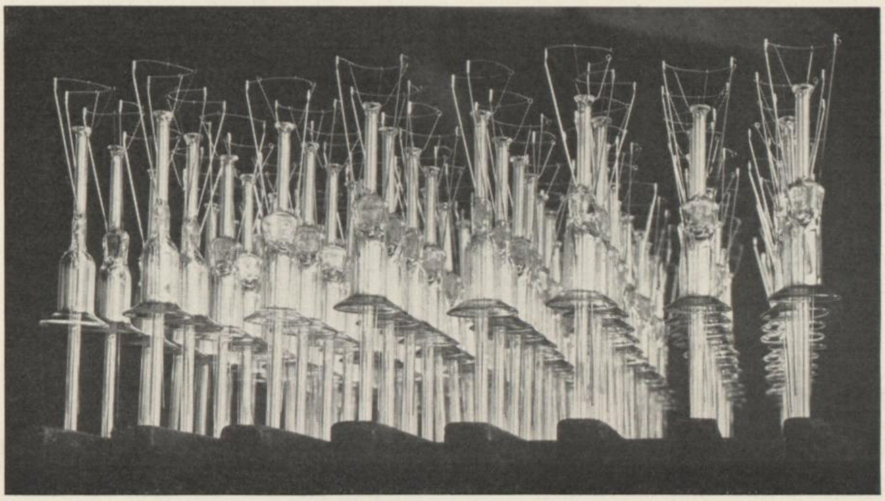
In this equipment laboratory, 150 equipment engineers, draftsmen, pattern makers, and machinists labor constantly in one of the most complete and modern machine shops in the world to create these delicate giants of lamp makers.

For years at a time a group of specialists concern themselves with a particular machine. The automatic stem, inserting, and mounting machine, which we will see next in the factory, was begun some ten years ago. Many of the same men who started its creation at that time followed it to its present state of completion in 1930.

A long time? Yes, but lamp-making at Nela Park may truly be called a creative industry. That is, it strives for newer mechanisms, more efficient machines, better methods. And to attain this high degree of perfection in its products, at the same time embodying refinements that constantly appear in lamp manufacture, is not the work of a few moments. Just as with this stem, inserting, and mounting machine, it often requires years of arduous and indefatigable labor.

About ten years ago, when tipless lamps began to appear, arose the necessity for a different type of manufacturing device. The single button stem, with coil filament, gave an opportunity for automatic mounting. If a machine could do this, rather than human hands, a still better lamp would result, with greater accuracy and with less strain on the glass from handling and heating. The outcome is this new machine masterpiece, which can turn out thousands of finished mounts in a day.

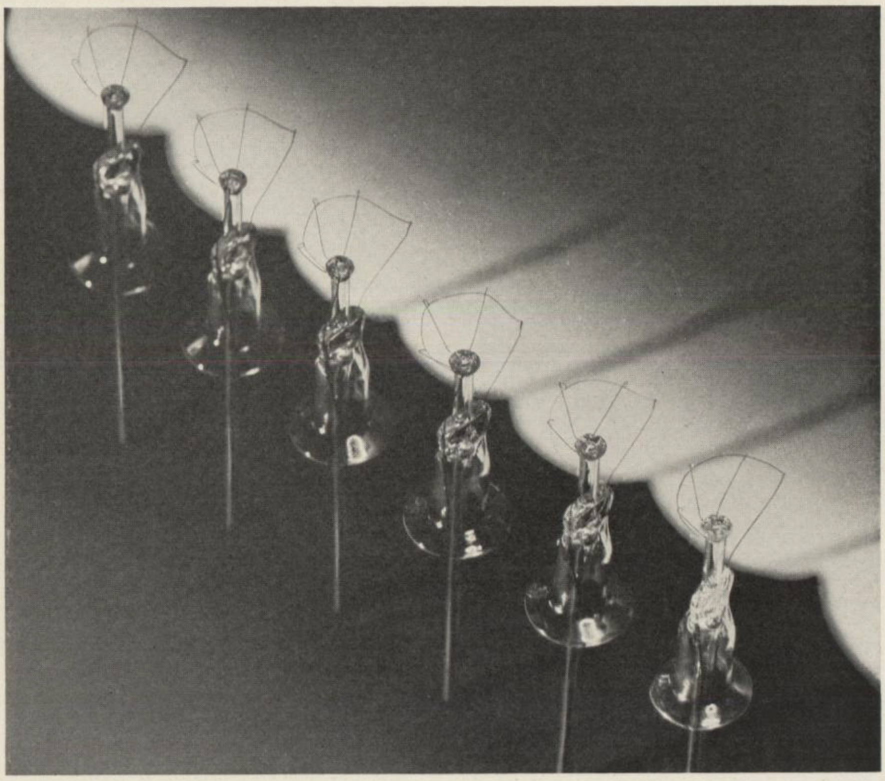
A glance at the complexity of this single machine will indicate the character of equipment development work. In the stem machine are over 15,000 parts—several thousand of them distinctly different in design, each requiring approximately two drawings. At all wearing points the machine is automatically lubricated from a central source—a new development in machine design and one which means much in perfect performance and perfect product. The cost of a single machine at the present time is many thousands of dollars—not to consider the cost during the years when special engineers and designers were constantly at work creating it.



A forest of 60-watt mounts

When a machine has been developed it is brought to the lamp factory at Nela Park, where it is immediately put to work. After thorough testing and possible refinements, it may be approved, and plans are then sent to the machine shop, where over 400 employees participate in making duplicates for use in the seven large lamp and three miniature lamp factories throughout the country.

Thanks to such constant and thrilling work of machine development and manufacture, lamp quality has constantly improved, while lamp prices have constantly declined.



Stem Making

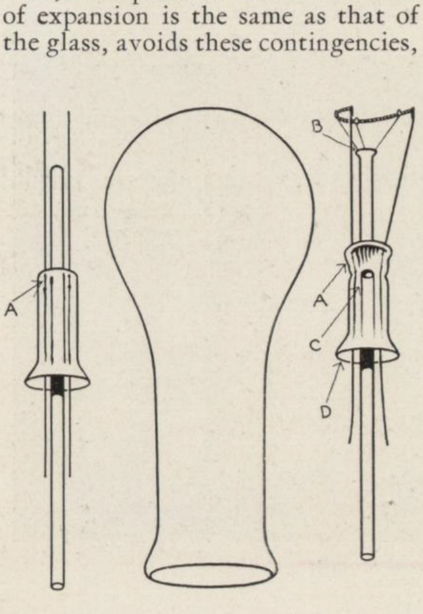
Back in the lamp factory, we pause at this machine whose first operation is making stems. Flanges, short glass tubes flared at one end, feed automatically, and the operator places two leading-in wires within each flange.

These leading-in wires, which pass through the glass enclosure of the lamp and connect to the electrical distribution system the light-giving element within, are made in three sections: of each wire the inner end, which is to support the filament, is of nickel. The center section is of Dumet wire. The outer lead, of copper, eventually forms contact with the base of the lamp.

The Dumet wire section is most interesting. Since this middle portion, as we shall find later, is to be sealed into the glass, the wire must have, through the temperature range, the same coefficient of expansion as the glass; otherwise, if the wire expands more or less than the glass which encases it, this action may destroy the vital hermetic seal, or possibly crack the glass. Dumet wire, a composition whose coefficient of expansion is the same as that of the glass, avoids these contingencies, and another step has been taken to safeguard Mazda lamp quality.

Automatically a length of straight exhaust tubing, also glass, feeds into the head which already holds the flange and two leading-in wires. As the machine rotates, fires play on the straight end of the glass flange, heating it to pliability and forcing it in toward the exhaust tube and the leading-in wires. When the glass has become soft two jaws of metal press against the heated portion, forming a single unit of the leading-in wires, the exhaust tubing, and the flare. So nicely calculated has been the whole operation that it is the Dumet wire section which is sheathed tightly within the glass.

A jet of air blown through the exhaust tubing from above forces a hole through the molten glass just at the juncture of the two tubes. Through this orifice the air is later extracted from the bulb, and the inert gaseous getter introduced.



At left, a length of exhaust tubing, a flange, and two lead-in wires go to make up the stem. A is the section of Dumet wire later to be enclosed within the glass seal. On the Sealex machine the bulb, center, is loaded over the mount, right. A *is the stem seal;* B *is the button holding the support wires; through the hole* C *and through the lower end of the exhaust tube the lamp is later exhausted and filled;* D *is the flare which is united by fire with the neck of the bulb. On the mounting machine the assembly appears upside down from its position as here shown*

Inserting

The inserting machine is virtually a part of the stem machine, the stems being automatically transferred to a moving chain on this second part of the device.

The tip of the "arbor"—the arbor being that portion of the exhaust tubing above the seal (here below the seal, as the stem is inverted for mounting)—is heated through successive steps. When the glass has become sufficiently hot a ram pushes up the end of the arbor, to form a button. Simultaneously three arms from deep within the machine grasp three lengths of molybdenum wire, inserting them into the button while the glass is still plastic. These are the wires which are to support the horseshoe-shaped filament.

Succeeding operations trim the leading-in wires to definite length, flatten the ends—in the case of a 60-watt lamp—and "wipe" them into a hook shape. At this position two small jaws grasp each lead wire and pull it downward, stretching it to remove any small bends, in preparation for the exacting operation of mounting the filament.

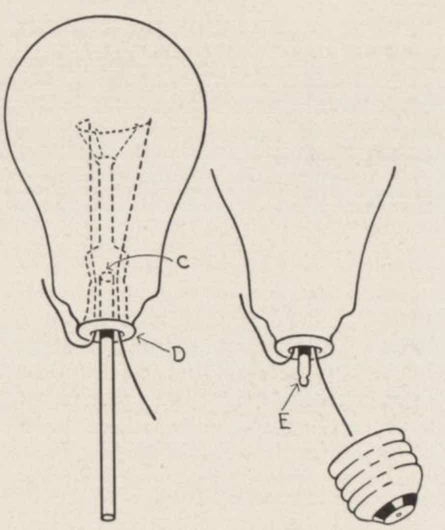
Mounting

An operator cares for coil feeding. The filaments which she lays upon the coil feed block fall automatically upon a shutter within the machine. So human is this iron workman that if one single part is missing, no other parts will feed in.

In an incredibly short time, while the machine has indexed forward only three or four positions, the filament has been flexed into horseshoe shape; the hooks on the leading-in wires have grasped its ends; and the tips of the three support wires have been looped about it to hold all points of the filament in one plane.

Before the machine finishes, however, each lead wire is given an additional squeeze to insure tight clamping, and metal fingers automatically adjust the mounted filament to its proper shape.

The mount is now transferred to another chain, passing in front of an inspector, who removes the mounts, examines them for distortion, proper clamping, and cracks, and sets them erect in a tray. Before the mounts pass to the next machine an operator applies a special "getter" solution. This chemical substance on the filament renders inactive any gases that may have been left in the lamp, and reduces the bulb-darkening tendencies of minute tungsten particles which deposit upon the inner surface of the bulb as the filament is burned at high temperature. The contingency that the bulb is not thoroughly exhausted is very remote, but this "improvement in vacuum" is simply one of the additional protective measures which insure perfect performance by the lamp.



At left, bulb and stem are sealed together ready for exhausting. C is the exhaust hole; D is the flare seal. At right, the bulb ready for basing. E is the exhaust tube sealed off after the original atmosphere has been exhausted and the bulb has been gas-filled

Sealing the Bulb

On the next machine the lamp begins to take form. This is a massive circular machine of two tiers, the upper for sealing and the lower for exhausting and filling.

An operator loads the mount into a chuck which holds it upright. In the stem machine we saw those mounts with arbor and filament downward. Here they are inverted, with filament up.

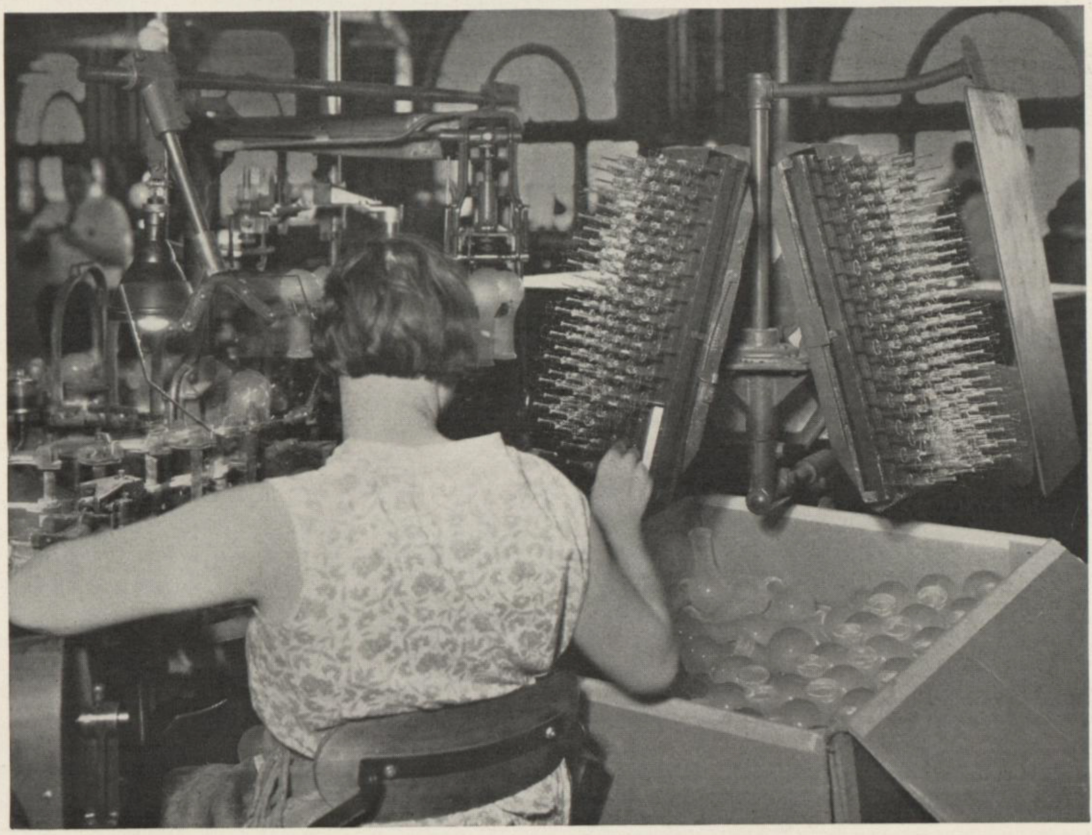
The same operator loads bulbs, as they come from the glassworks, onto a small revolving turret on her right, which stamps the G-E monogram and the lamp rating on the bulb and automatically loads it over the mount on the sealing machine.

As the sealing turret rotates, fingers of fire play against the neck of the bulb at the point where, inside, the flare on the mount projects toward the sides of the neck. These fires fuse the bulb and the flange together, forming the seal which later fits into the brass base. Other knife-like points of fire, directed just below the seal, cut off the waste glass.

While all this has been going on, flames directed against the top of the bulb burn in the G-E monogram.

Exhausting and Filling

As the sealed bulb and mount pass in front of the operator, deftly she transfers the lamp to the lower turret on the machine, connecting the glass exhaust tube with the exhausting and filling facilities of the ma-



The operator of the Sealex machine not only inserts the mounts from the trays at her right, but also loads bulbs onto the small turret (partly obscured by head) and with her left hand transfers lamps to the lower turret for exhausting and filling chine. When the machine indexes to the "vacuum position" most of the air is removed, through the orifice just above the lead-wire seal, and through that portion of the exhaust tube projecting below the lamp. At this stage, pressure within the bulb is only a fraction of atmospheric pressure—at Cleveland normally 740 mm.

At succeeding positions the bulb is alternately flushed with getter gas and then exhausted, thus diluting the original atmosphere until the amount left in the bulb is only one part in millions.

When the original atmosphere within the bulb has been thus diluted, the machine fills it with argon, a rare gas which is frozen out of the air at temperatures far below those usually realized and at pressures much greater than those commonly attained. This inert gas is used because it will not aid combustion; that is, nothing will burn in it. Not only does it thus permit operation of the filament at a higher temperature, but restrains the deposition of volatilized particles on the surface.

Jets of flame are now directed against the exhaust tube, a slight upward pressure being exerted against the bulb. As soon as the glass softens, this tube parts, and molten glass closes in to form a perfectly airtight seal. After this the machine automatically delivers the bulb into a container ready to receive the brass base by means of which it fits into the ordinary everyday lamp socket.

Basing

The operator of the basing machine has before her a tray full of bases. These consist of a brass shell, threaded, the contact base being a brass eyelet insulated from the sides by opaque glass. Just within the open end of the shell is a quantity of a special cement designed to hold the base firmly against the bulb.

The operator threads one leading-in wire through the eyelet in the base and bends the other up against the side of the bulb. Pressing the base firmly against the glass and this leading-in wire, she places the bulb, base up, in the basing machine, which carries it through successive heating processes that bake the cement tightly onto the glass and the shell of the base.

After baking, small knives trim off the ends of the leading-in wires close to the base. Now two metal fingers dipped in soldering flux press against each of these leading-in wires and the adjacent parts of the base, depositing drops of flux.

Soldering wire is fed from large spools into cutting dies, which snip off small cylindrical slugs. A sharp steel rod jabs into each slug, withdraws it from the die, and then presses it against the leading-in wires, which fires solder firmly to the base on both side and bottom.

The final two operations are flashing and inspection. As the lamps are lighted through successive positions of the machine, the chemical getter, driven from the filament, volatilizes and acts within the bulb as previously explained. As the lamp comes into position before the operator and is again lighted behind a darkened glass, the inspector checks it for flaws in the bulb, position of filament, and other possible defects.

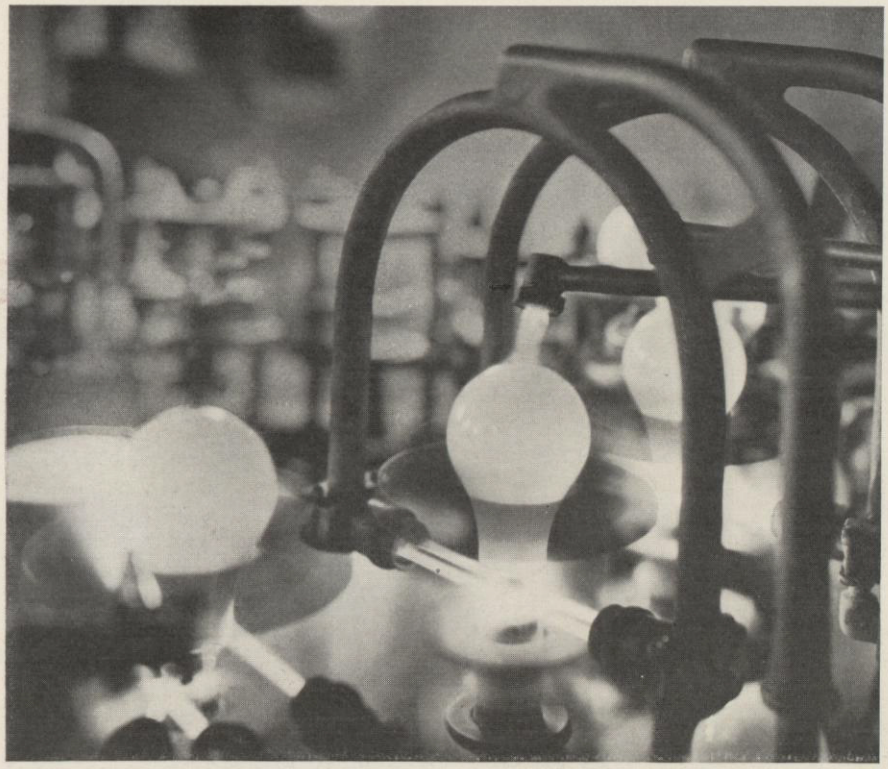
The lamps are removed, again inspected, unlighted, for blemishes, monogram, frosting, soldering, straightness of base, and numerous other defects, and then packed in sleeves and in cartons. But that is not all. Even with these rigid checks, MAZDA lamps undergo other tests to insure their reliability.

MAZDA Service Inspection

The unsealed packages of standard quantity pass, on a constantly moving belt conveyor, before a battery of MAZDA Service inspectors, who scrutinize each package of lamps in search of one or more of 150 listed possible defects. In adherence to its standards of offering products as perfect as human alertness and mechanical ingenuity can create, the General Electric Company employs the Electrical Testing Laboratories to make this independent appraisal of its lamps.

In the factory these latter tests are regularly applied to sample lamps from each machine several times a day. Among these are base strength tests, spot tests, and life tests at normal and at forced voltage. Daily the life-testing department alone consumes electric current equivalent to that used by a city of 40,000.

Thus is created the present-day MAZDA lamp. After bases and filament wire have been made, and bulb and tubing have been blown, approximately eleven operators and four highly-complex, modern machines participate in assembling this maze of component parts into the finished lamp. That for twenty cents anyone can purchase a device into which has gone so much skill, planning, precision, and care is one of the amazing facts of industrial progress. Light is effectually bottled, ready at a moment's notice to bring to millions of people untold comfort, convenience and pleasure.



At this section of the Sealex machine the waste glass of the neck is sheared off by knives of fire, while flood fires burn in the G-E monogram on the top of the bulb

WHAT NELA PARK AND ITS ORGANIZATION MEAN TO YOU

(*Continued from page 9*)

you a constant public demand and acceptance.

Here at headquarters is located the Sales Promotion organization which prepares and issues the advertisements in leading magazines; radio programs, window and store display material; sales campaigns, etc., etc.

But it does more than merely sit and write and plan. Most of its members are constantly out in the field talking with jobber's salesmen, with retailers, central station men; finding out what type of advertising gains the greatest response from the consumer; ascertaining by tests what types of window displays produce the greatest sales for the retailer; running experimental sales campaigns, etc., so that when the material you see and use finally comes into your hands, it is tested almost as thoroughly as the lamps which you sell.

Sales Department

The salesman you see from the Lamp Division which serves you on lamps is part of a nation-wide sales organization whose headquarters are also located at Nela Park. These sales heads, like yourself, as manager of a store or institution, direct the selling efforts of their salesmen; shape their organizations to serve you and assist you in building greater sales and making greater use of the product which they represent. With them is a Credit Department which, like yourself, or if your business is a large one, your own credit department, keeps its fingers on field conditions, and counsels as to the desirability of channels of distribution from a credit standpoint.

Here then is a bird's-eye picture of the Nela Park Organization of the General Electric Company—a group that has provided for the consumer quality in a product that was undreamed of a quarter of a century ago—that in one development alone, the 40-watt gas-filled Mazda lamp recently announced, is giving consumers a saving of over forty-three million dollars a year in the cost of light; a group whose ingenuity has provided the lamps that light at the touch of a finger in your home, office or factory; an organization whose inventive genius has produced the special lamps that the surgeon uses in saving life and promoting health; the recently introduced photoflash lamp that makes possible taking a picture as easily by night as by day; the sunlamp whose life and health-giving rays are putting summer sunshine into the darkest and most remote corners of the country.

An organization whose progressive thinking has given to the merchandisers of lamps an agency plan of distribution, which eliminates the evils of price cutting and loss through obsolescence; which guarantees to consumers *equal* prices and *equal* quality for *equal* quantities of lamps.

An organization which conceived and promoted the idea of lighting education through the training of lighting engineers for jobbers and utilities, and through the visual education of consumers in its Lighting Institutes.

A group who has initiated and developed the majority of the developments in lamps, equipment and application.

And remember, when we speak of the organization at Nela Park we speak of that organization as representing the country-wide force engaged in the manufacturing, engineering and sale of the Mazda Lamp made by the General Electric Company. Many of the ideas finally developed at headquarters in Cleveland have come from the clear-thinking, field individuals who pass on to their chiefs the ideas which you, as a seller or consumer, as well as they themselves, are continually evolving.

What will the next ten years disclose?—new lamps—new efficiencies—new fields—new applications—new sales methods? Whatever they are, we can safely leave these developments in the care of that organization which has already contributed so much.

KRESGE HEADQUARTERS ACHIEVE SUPREME LIGHTING

(*Continued from page 29*)

Executive Offices

The office of Mr. S. S. Kresge, Chairman of the Board, with its panels and moldings of rich French walnut, its doors of Australian lacewood with English oak inlays, and teakwood floor, is a model of simple, rich dignity. The lighting fixtures, modern in design, consist of concentric square and hexagonal opal glass forms. The four corner units are equipped with 150-watt Mazda lamps. The center unit has one 300-watt Mazda lamp. The fixtures are open at the top and closed at the bottom for diffusion purposes.

President C. B. Van Dusen's office has panels of burled American walnut. The doors are of American walnut with sequoia and rosewood decorations. The lighting in this office differs from that in Mr. Kresge's office only in the decorative treatment afforded the fixtures.

Typical Offices

These are equipped with 200-watt lamps in Holophane Filterlites, and are in general on 8 by 10 foot spacings. The ceiling and side walls are finished in light colors, thereby insuring a high overall utilization.

Lounge Rooms

The surroundings are strictly in keeping with the most modern office methods: proper conveniences and comforts have been arranged for the employees by the provision of modern cafeterias and dining rooms, beautiful lounge rooms, and hospital service.

The lounge rooms typify solid comfort. Here during the luncheon period the employee may find relaxation. General illumination is supplied from six 200-watt decorated opal glass units at the ceiling. This is supplemented by portable reading lamps located with respect to tables and chairs. Magazines, a radio, a piano, and games satisfy every want.

The rooms where there is a possibility of annoying noises have sound absorbing ceiling treatments, and rubber tiled floors which assist in the absorption and reduction of noises. The lighting in the cafeteria is first of all utilitarian in its aspect. Fixtures of the closed ceiling type and of inverted pyramid shape, however, add a decorative touch to the entire interior. These fixtures are made of opal glass and each contain three 40-watt Mazda lamps.

Thoroughly in keeping with the modern spirit of business, the new offices of the S. S. Kresge Company are a happy combination of efficiency, beauty, and dignity. Comfort for their employees, as witnessed by the lighting, heating, ventilation, and medical attention, has been given foremost consideration.

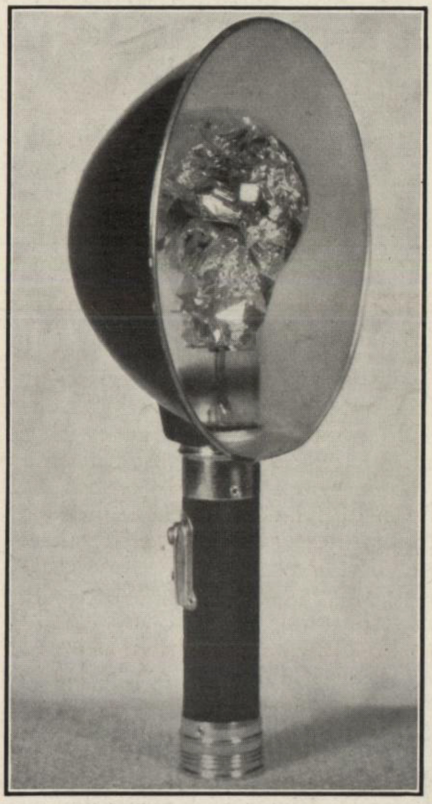
CORCORAN

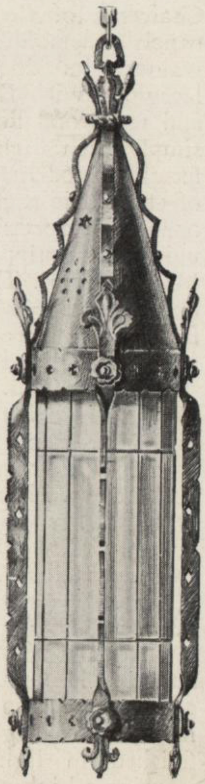
WHEN the Master Photo Finishers decided to promote the sale of MAZDA Photoflash Lamps, they realized that if the amateur is to get good pictures he must have reflecting equipment. They also knew that for this equipment the amateur would not be willing to pay a great deal. To answer the need for something inexpensive that was at the same time durable and reliable, the Master Photo Finishers working with the Thos. J. Corcoran Lamp Company developed the reflector shown here. This reflector is made in both the battery and the cord types. The battery type uses two standard 1¼-in. diameter flashlight cells. The reflecting surface is chromium plate nickel. At the left of the handle, near the top, in a comfortable location for the thumb is a momentary button switch.

Although sold by the Master Photo Finishers, these reflectors can be obtained through photographic houses or direct from the manufacturers—the Thos. J. Corcoran Lamp Co. of Cincinnati.

BRIGHT STAR

Another popular reflector in the wide-spread field of photography, employing the MAZDA photoflash lamp, is the Bright Star Reflector. The illustration to the right shows the complete unit with battery holder, patent switch and reflector ready for immediate use. It is made by the Bright Star Battery Company of Hoboken, N. J.





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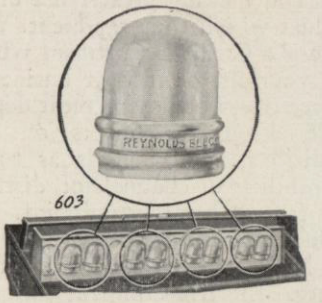
Color
IN
FOOTLIGHTS



Reco COLOR HOODS

For 10 to 500 W. lamps provide the true brilliant color necessary for the marvelous lighting effects of the modern stage. Reco Natural Colored Glass Hoods give maximum light transmission.

Write for Bulletin 78

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